

Diffraction Imaging of Yeast: strategies and limitations of high resolution imaging of a whole cell

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The Stony Brook x-ray microscopy group has designed, constructed and commissioned a novel microscope for soft x-ray diffraction imaging. The microscope, currently installed on beamline 9.0.1 of the ALS, has been used to image a single freeze dried yeast cell in both phase and absorption contrast simultaneously to 50 nm resolution through inversion of its soft x-ray diffraction pattern. A stereo pair of images were also reconstructed to similar resolution showing depth information in the cell and lending confidence to the structure that was recovered without the use of other microscopies. An analysis of the effects of accumulated dose to the sample is made through characterization of changes in the speckle pattern as the sample is irradiated. It is observed that the cell suffers from an initial collapse which is followed by a continued uniform shrinkage and that the resolution obtained in the diffraction pattern seems to follow an inverse fourth power scaling with dose as is predicted. These results are then compared and contrasted with initial measurements made on a frozen hydrated yeast cell.